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The MONTHLY REVIEW

Published by the

American Electro-Platers' Society

A SOCIETY FOR THE ADVANCEMENT OF THE SCIENCE OF ELECTRO-PLATING

Entered as second class matter at the Post Office at Springfield, Mass., September 8, 1930, under Act of August 24, 1912.

Acceptance for mailing at special rate of postage, provided for in section 1103, Act of February 28, 1925, authorized September 3, 1926.

JANUARY . . 1935

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The MONTHLY REVIEW

Published by the
AMERICAN ELECTRO-PLATERS' SOCIETY

Publication and Editorial Office
90 Maynard St.
Springfield, Massachusetts

VOL. XXII JANUARY 1935 NO. 1

Progress

An Editorial
By Geo. B. Hogaboom

IN all the history of electroplating there never has been such definite progress toward the goal of the American Electro-Platers' Society as there has been in 1934. The research work of the Society is bearing fruit and there is the promise of many more developments the value of which cannot be estimated.

The completion of the work and the report of the research on "The Protective Value of Electroplated Coatings on Steel" has made history. This will be followed by the establishment of definite specifications for electrodeposited coatings.

The spontaneous support of a research on Non-Ferrous Metals at the Detroit Convention was the highest compliment that could be paid to the American Electro-Platers' Society. The spirit of the meetings were that "Research Must Go On." This work has been started and the outline of the program insures the assembly of information that will greatly advance the electroplating of metals.

This new year we are entering upon will see still more remarkable advancement. By March specifications for electroplating of steel will be adopted by the joint committee of the A. E. S. and the American Society for Testing Materials.

In the same month there will be a Congress of Metals in London, England, held under the direction of The Faraday Society that will bring together the greatest assembly of scientists who have devoted their lives to the study of metals in the history of the world. Electroplating is to play an important part in the program and this country and the A. E. S. will be represented by the best qualified man in the electroplating field, Dr. William

Blum. This well deserved and earned honor will be hailed by every member of the A. E. S.

June will bring an Exhibition of Electro-plating Supplies, Equipment and Products that have been electro-plated. This will make a milestone in the history of A. E. S. that will be marked as a memorial to the progressive spirit of its members.

Bridgeport Branch has as its slogan for the 1935 Convention, "How It Is Done." Come and see.

The Society is deeply indebted to the National Bureau of Standards for the unstinted support it has given Dr. William Blum, his associates and the A. E. S. Research Fellow, Mr. Paul Strausser.

The A. E. S. has one debt that will be difficult to repay and that is the generous support of its research work by the United Chromium Corporation. When it seemed that the work would have to be discontinued at a critical time the officials of that organization came forward voluntarily and gave the financial support necessary to carry on. The A. E. S., man for man, appreciates that contribution to its endeavor to maintain its ideal "An Educational Society," which can only be done by research work.

GEO. B. HOGABOOM.

Will each Branch Secretary please send to the Editor, at once, a complete list of members and their correct addresses now on his books? This is necessary at this time so that we may check our mail list and bring it down to date.

Plating Plant Layout

By A. J. LUPIEN
Udylite Co., Detroit

Read at Detroit 1934 Convention

THIS subject of Plating Plant Layout is undoubtedly so familiar to you that it needs no introduction. There is probably not one of us who, at some time or another, has not been given the responsibility of arranging his plating equipment in a manner efficient and economical.

PURPOSE

The purpose of this paper is *first* to enumerate the important factors generally considered when laying out a plating plant; *second*, to discuss some causes of poor layouts; and *third*, to bring out a few examples of plating departments as they were and how they have been corrected.

Although the majority of plating departments have been inherited by the plater, he certainly should do all he can to make his department flawless. Where he is faced with the problem of laying out a new plant, he should study diligently the governing circumstances, and make his ideas known to the Engineering Department. His contact with this department should be so close that his O. K. will be sought before any proposed plan is carried out.

TECHNIQUE OF PLANT LAYOUT

Perhaps the best method is to draw to scale a diagram of the proposed space. This diagram should show the location of posts, windows, doors and present drains. Then all the tanks and generators should be drawn to the same scale on a separate piece of cardboard in terms of their overall widths and lengths. When this has been done these tank diagrams should be cut out and arranged on the "floor space diagram" in different ways until the most suitable layout has been found. You can readily see how much easier it is to use this method than to draw up a large number of complete sketches.

IMPORTANT FACTORS

It is during this process of diagramatic layout that attention should be paid to the following factors:

1. *Economy of space*—not only of space taken up by the equipment, but also of that allowed for aisles, loading and unloading areas. This is very important in large modern plants where the cost per square foot of floor area is high.

The smooth flow of the work—which means laying out to fit the operations preceding those in the plating department as well as those which are to follow. The work may be entering the plating department at one end and leaving at the other, or it may be entering and leaving at the same end. The layout then should be planned to fit such local factors.

3. *Efficiency of processing*—in which is included *cost of labor* and *ease of handling*. The equipment should be arranged to eliminate long distances of travel and to cut out any unnecessary motions on the part of the men. Walking several feet more than is necessary may not mean much during the first hour of work each day, but over an eight-hour period it cannot help but slow down production. Each man should preferably work in his own space. When this is not possible the aisles should be made large enough to allow the operators to pass one another with ease even when they are carrying racks of work. Attention should be given to placing the tanks at a level where the workmen will not have to lift too high nor bend over too low.

4. *Conservation of Electrical Energy and Materials*—Thought should be given to the placing of the generator so that a minimum of bus bar is used and so that the generator itself is protected as much as possible from corroding fumes. A minimum of bus bar means a minimum of joints which frequently are the sources of appreciable drops in voltage. This same thought of conservation should be carried through with regard to all materials such as exhaust systems, when needed. In this case it is customary to make the ducts as short as possible to preserve their efficiency.

Frequently there will be a conflict between the requirements for efficiency of processing and conservation of materials, requiring good judgment. In general the efficiency of processing will predominate in the final compromise.

5. *Appearance*—This enters the discussion because it is so easy to build a plant which meets most requirements. By appearance, it is not meant that all tanks should be set in perfect symmetry, which is often an expensive luxury. Rather, equipment should be arranged so that a minimum of solutions are spilled on

the floor. This is not only a question of appearance, but also one of efficiency of process—because wet floors are slippery and men do not get over them as easily as over clean, dry floors.

REVAMPING EXISTING LAYOUTS

However, as stated before, plating departments are for the most part inherited. The plater gets them after they have been in operation for years and have had so many pieces of equipment added to them from time to time that no one can follow a procedure of operations that will save time and money or eliminate waste. When changes become necessary a thorough study should be made to determine the best methods of meeting the new requirements. It is often surprising how much costs can be cut by revamping the layout. Each job of any volume requires a layout of its own, and the sooner we learn to consider changes in layout to fit a particular job, the sooner costs will be cut to a minimum.

TYPICAL CONDITIONS NECESSITATING LAYOUT CHANGES

Perhaps there is no better way to explain what is meant by revision of plant layout than to relate some typical conditions encountered in several plants during service calls.

In the first instance, the cause of the trouble was that the layout no longer fitted the job. The installation had been originally put in to handle automobile hub caps. Provision had been made to take care of future increase in production, but when business picked up to the point where these figures were reached, the hub caps themselves had larger circumferences, deeper recesses and, consequently, more surface. The plating plant layout would have been just right if the job itself had not changed.

Now, in this particular plant the haphazard addition of the necessary tanks to handle this new type of hub cap would have entailed a greater unit cost of production. This was so because the new tanks would have to be placed in the plating room in locations which would require more labor and more walking to the plating tank and from it, more solutions dripping on the floor, and a criss-crossing of the various operators.

Consequently, the tanks could not be operated at full capacity. Too much time would be lost just running around. Against this condition the plater could revamp the layout, insert at the proper spot a new and larger tank in place of the old one, or another additional tank to care for the increased production. He figured

out how long it would be necessary to shut down in order to make the change, and how much this shut-down would cost his company. He also figured out how much the additional equipment would cost.

It was obvious that the initial cost of just adding another tank, anywhere in the plating room, would be lower. It was impossible to figure out where the increased cost of production would lead, because this increased cost in so competitive a field, might result in the loss of the job. The plater favored a revamping of the layout, and backed up his judgment with such sound argument that he was allowed to go ahead. Since then it has been learned that it would have cost the company over four times as much to operate the department without revamping — and, an official adds, "there would be no end in sight yet."

The second instance involves a company in whose plating department a high percentage of rejects had suddenly developed. At first there was apparently no reason for this condition — the men were old employees, the work had not varied, the solutions were in good shape and the layout had not been changed. However, the reason for this condition was soon brought to light.

About a week before the service call, a new system of "group payment" had been put into effect. While the operators were being paid on an hourly basis, the inefficiencies of the layout did not become apparent; time lost between tank loads was taken as a matter of course. With the change in the system, however, the operators needed every available minute to benefit their own pay envelopes. This resulted in their trying to speed up operations by reducing the plating time and the cleaning time, with the consequent non-uniformity of cleaning and plate coverage, not to mention the variations in thickness of plate on the various rack loads.

In the presence of the foreman plater the operators followed specifications, but he could not be watching his men all of the time. Nor could he lay the blame to any one man because the layout was such that each operator had a hand in each operation. The layout was changed to suit the new condition; the equipment was replanned so there would be no loss of time, and so that each operator was made responsible only for a limited number of operations. This eliminated the trouble.

SKETCHES OF LAYOUTS

Typical layouts shown in the illustrations, demonstrate the points just brought out. In the first system, each of the two men operators takes work from the racking bench after it has been racked. Let us follow the men through the various plating operations:

Operator No. 1		*Operator No. 2*	
Operation		*Operation*	
# 1	Clean in tank # 2	# 1	Clean in tank # 2
# 2	Rinse in Tank # 10	# 2	Rinse in tank # 8
# 3	Pickle in tank # 3	# 3	Pickle in tank # 3
# 4	Rinse in tank # 10	# 4	Rinse in tank # 8
# 5	Dip in crock # 6	# 5	Dip in crock # 6
# 6	Rinse in tank # 9	# 6	Rinse in tank # 9
# 7	Rinse in tank # 11	# 7	Rinse in tank # 7
# 8	Plate in tank # 5	# 8	Plate in tank # 4
# 9	Rinse in tank # 12	# 9	Rinse in tank # 12
# 10	Rinse in Tank # 13	# 10	Rinse in tank # 13
# 11	Dry in tank # 14	# 11	Dry in tank # 14

From operation 1 to 8 inclusive there is a lot of unnecessary retracing of footsteps (See Figure 1). This causes a lot of time which the operator tries to make up by reducing the plating and cleaning periods.

The above conditions could be overcome by changing the layout so that the proper tanks would follow one another in a direct line, just as is done in a full-automatic plating machine. Figure 2 gives a clear picture of this.

In this set-up each of the two operators has his work definitely cut out for him. Operator # 1 takes the work from the racking bench and, after moving it successively through tanks 1,2,3,4,5 and 6, finds himself back at the racking bench ready to repeat the cycle. There is no lost motion, no unnecessary floorwalking with racks dripping with several different kinds of solution. Operator # 2 starts his cycle at tank 6. From here he, too, goes in a complete circle to tank or 8, as the case may be, and thence on to tanks 9, 10 and 11. At tank 11 he is well on his way to tank 6, ready to repeat the operations.

The work itself starts and stops at the racking bench where operator can do both the racking and the drying operations.

Another advantage in this set-up is that any parts rejected be-

cause of cleaning can be brought to the attention of Operator 1, while parts rejected because of poor plating can be changed to Operator 2. The observance of orders, regarding the time of cleaning and the time of plating, is almost certainly assured with this arrangement, thus entailing much less supervision.

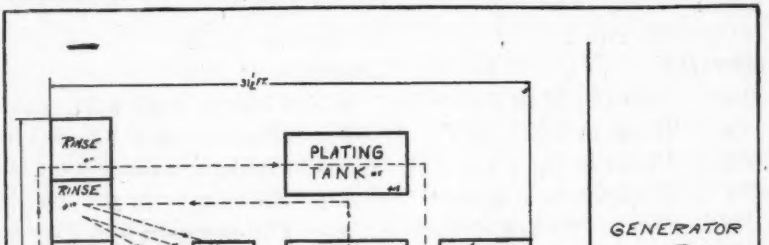


Figure 1

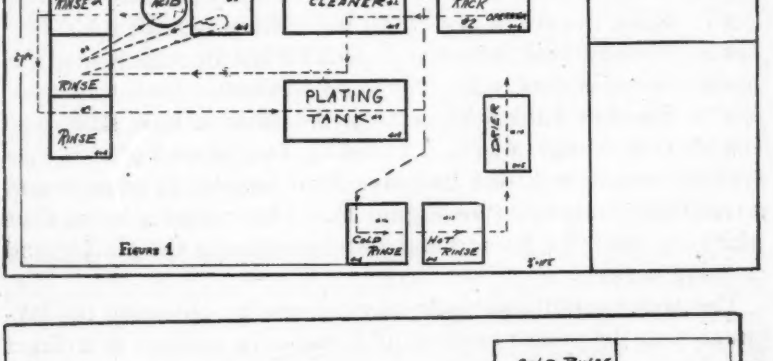


Figure 2

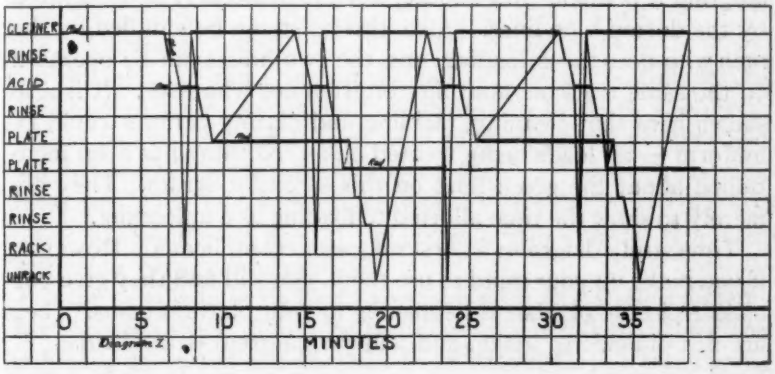
TIME STUDY

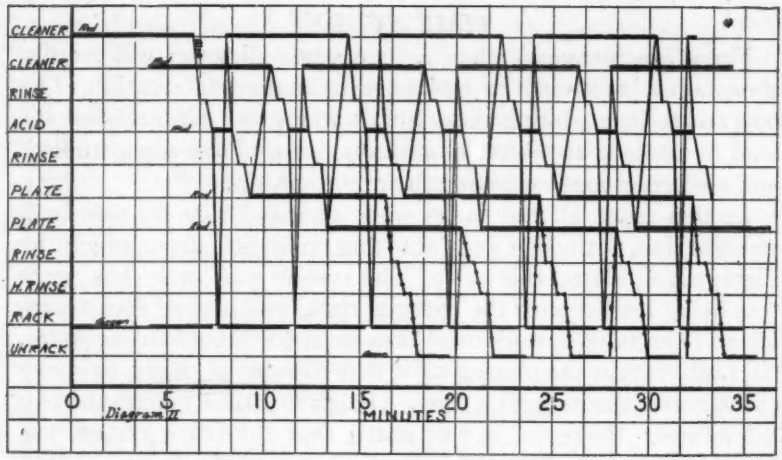
There are instances when a time study diagram will readily show how a layout can be replanned to increase production. The operations in a plating department where the plater lifted his load in and out of the tanks with an electric hoist were studied, and a diagram made charting their relationship.

In this plant all the tanks were arranged side by side in a straight line, with their ends abutting on an aisle from which the plater manipulated this hoist. The system was such that work was being loaded onto the cathode rods, which were then transferred from tank to tank until they reached the unloading space. All tanks except the plating tank were capable of taking only one cathode rod assembly at a time. The plating tank could take two assemblies. However, it was noted that the plating tank was being used to only half of its capacity most of the time, and that not much more than half of the production expected was being turned out.

We made a study of the sequence of operations, the minimum time necessary for cleaning, and of the time necessary for making the transfers. The diagram time study shown in Diagram #1 pictures what was happening. The red lines designate the periods of rest in the cleaner, the acid and the plating tanks. The blue lines designate the periods of travel of man and hoist.

Let us follow the plater on the diagram beginning at the time his first load is ready to come out of the cleaner tank. He picks up the load, rinses it in water, and after transferring to the acid tank, where he lets it rest, he moves down to the loading area for another load. The new load having been picked up and been





placed in the cleaner tank, he goes back to the acid tank where he picks up the first load, rinses in water, and places it in the plating tank. After he had done this he must wait for his second load to be cleaned before he can continue his operations — this leaves one-half of the plating tank empty. During this waiting period the plater can help in the loading of another rack, but the process of plating is not benefitted in any way.

The diagram shows that the cleaner tank is the "neck in the bottle." If we were to double the size of the cleaner tank, would we then solve the problem? The second diagram, Diagram # 2 in which the red and blue lines have the same meaning as in the first diagram, shows that it would not. For in this case the plating tank would become the "neck in the bottle." From this second diagram it is found that another hoist is necessary, as designated by the dotted blue lines. Also, this hoist can be handled by the man who does the unloading, and the two hoists can be operated on the same track without any interference whatever. It is also shown here that cleaning, pickling and plating periods would be uniform — all loads being treated alike. Nothing has been mentioned about the green lines on this second diagram. They are merely to show the time allotted to loading and unloading.

Time study diagrams at first may seem complicated. However, if you make up your mind to use them, you will find they give you a clear picture of what is happening in your plating rooms. They are not difficult to make, and will save a great deal of time.

Procedure in Nickel Plating

By RAY GOODSELL
Milwaukee Branch, A. E. S.

Read at Detroit 1934 Convention
By A. J. HERMANSEN

THERE are two kinds of Nickel Plating, namely, good and bad. It is the purpose of the writer to bring out the principal facts pertaining to good nickel plating. We are mostly interested in a nickel finish used for decorative purposes, to be chrome plated, so that a satisfactory looking and so-called rust proof surface is obtained.

It is a well-known fact that a chrome deposit over steel is not rust proof. It is the underlying coat of copper and nickel that forms the base of a so-called rust proof job. The term "so-called rust proof" is used, as it is the belief of the writer that iron or steel are not rust proof when coated with any metal deposit, but satisfactory jobs can be done that will pass either a salt spray or a ferro-cyanide test, if the proper procedure is followed. As this paper is to outline the procedure in nickel plating, we will confine ourselves to the title.

Nickel plating may be divided into eight different operations:

1. Metal to be plated
2. Pickling
3. Polishing
4. Cleaning
5. Copper plating
6. Copper buffing
7. Nickel plating
8. Nickel buffing

Probably the most important part of nickel plating is the selection of your base metal. If steel is to be used, the metal should be free as possible from pits, as these pits, if not polished out, are one of the main causes for corrosion. If you will examine these pits with a powerful microscope, you will find particles of black scale and even rust at the bottom, which unless removed, will cause rusting much quicker.

If the steel is to be pickled to remove scale, it is well to remember that the work should be thoroughly neutralized before the polishing operation and that the work should be put into opera-

tion as soon as pickled. It is not good practice to pickle too much work ahead.

The writer recommends the use of good cold rolled steel, as it is a saving in pickling and polishing, and is more free from pits. Good steel can be bought for a few cents more per pound and will save several dollars in polishing.

About three years ago, a certain manufacturing concern was paying 45 cents each for polishing an article to be copper, nickel and chrome plated. Radiator casing stock was used for base metal. The same company today is using a high-grade cold rolled steel and the same job costs 16 cents each. Such articles as radiator shells, car heater frames, toasters, etc., can be finished at a much lower cost and a much higher grade of finish can be obtained.

Where work has to be pickled, it is necessary to remove all scale and if work is not to be polished it is recommended that the articles be scratch-brushed to remove all particles of scale and dirt.

The polishing operation is one of the most important in high-class plating. Good polishing cannot be done unless the operator is supplied with the proper polishing wheels and these must be kept in proper condition. First is the selection of a good grade of polishing glue, which must be soaked in cold water before cooking. Clean glue pots and proper cooking of glue are very important. A fresh solution of glue should be made every day. Glue should not be applied to a wheel in a cold room or to the surface of a cold wheel, as the glue sets too quick and you will not get a good set-up of your polishing wheel. Polishing wheels should dry naturally for at least 24 hours. Do not dry in a hot oven, as it causes the glue to become brittle. Polishing wheels should be properly balanced and dressed off to a smooth running surface.

If steel is to be polished, first use grease on the wheel to avoid burning and warping of the metal. Remove all pits in the first operation.

Radiator shells are polished first with 150, then 180, and finished on 200. A cemented sheepskin wheel is used for the final polishing operation. It is the belief of the writer that if all pits and wheel marks of the previous wheel are removed by the sheepskin wheel coated with 200 emery, and the work is properly copper plated and buffed, nickel plated and buffed, chrome plated

and buffed, that your finished article will be entirely free from wheel marks, which is one of the causes of breaking down under salt spray or ferro-cyanide test. A good cleaner heated to the boiling point is essential for good plating. Use a stronger cleaner for steel previous to copper plating, and be sure that all the grease film is removed. Rinse first in hot water and then in cold. Soaps from your cleaner will harden if rinsed in cold water first, and will cause blistering of copper deposits if not removed. I have been using a cyanide dip previous to copper plating, as I have found that an acid dip ruins the tank and cement floor and a cyanide dip is just as efficient as acid. The copper bath is made as follows:

Copper cyanide	4 oz.
Sodium cyanide	4½ oz.
Soda Ash	2 oz.
Water	1 gal.
Temperature	110° F.
Plating time	20 minutes

The conveyor system is much superior to still plating, as a much more even deposit is obtained as the work travels around the plating tank, which changes the position of the work and agitates the solution, and if there happens to be a poor connection on anode or on the work rod, it does not hinder the plating as much as if the work is standing still. Buffing of copper on radiator shells to remove all wheel marks and to obtain the highest finish is a work of art. A good copper buffer will get inside a shell and buff cross-wise, as this will cover any wheel marks that happen to be sharp. Coloring is done length-wise, using a soft cotton flannel buff and lime compound for polish. Sewed muslin buffs and harsh compounds leave scratches in the copper plate that will show up after chrome plating. Use a mild cleaner before nickel plating.

Articles that have odd shapes which are apt to collect compositions should be thoroughly scrubbed, using a soft cotton mop. Cyanide dip and plate in a copper solution for three minutes. The writer has found this is a very important operation, and has installed a copper tank on the cleaning line for the purpose.

Copper plating any metal before nickel plating has several features that are very important. First, on a steel article that has

been previously copper plated and buffed, you will put back as much copper as was buffed off and where there are corners that have cut through to the steel they will again be coated with copper. Second, it gives a better plating surface for nickel. It has been proven that nickel plated articles that have been copper plated before nickel plating are much less liable to peel when chromium plated.

Rinsing after copper plating is very important, and two cold water rinses should be used so that all traces of cyanide solution is removed before nickeling.

So much has been written on nickel plating that it will not be necessary to go into much detail on this subject. We use the following nickel formula at our plant:

32 oz. single salts
3 oz. boracic acid
3 oz. nickel chloride
pH. 5.02
Temperature 110 F.
Plating time 15 minutes

We have reduced the temperature from 120 F. since a year ago, for the following reason: Our line of plating varies, and we are required to throw nickel plating into deep recesses and find that the higher the temperature the less throwing power. In using warm nickel it is necessary to keep articles farther apart to avoid shading and to get an equal deposit on all sides. Pitting has been eliminated by the use of sodium perborate or hydrogen peroxide. Better results have been obtained with the use of these chemicals when the acid is high in the plating solution. Nickel buffing should be done on a soft buff to eliminate all buffing scratches, and the work should be kept clean.

Cleaning before chrome plating adds to the efficiency of the chrome bath, using the following cleaner:

2 oz. soda ash
2 oz. trisodium phosphate
Temperature, 200 F.

Dip in a 20% solution of sulphuric acid to remove all traces of cleaner, rinse and chrome plate for three minutes. Our chrome bath is heated to a temperature of 100 F., and requires buffing only to remove water stains.

CHAIRMAN SLATTERY: Mr. Hermansen informs me that if

any of the members wish to ask questions he feels he would be able to answer them. Are there any questions on this paper?

MR. HENRY JAMESON: (Detroit Testing Laboratory, Detroit, Mich.): Regarding that copper deposit, the speaker stated a twenty-minute deposit, but he failed to state the current density used, as well as the current density used in the nickel deposit.

MR. HERMANSEN: I am not positive that I can answer that question exactly, but I believe Ray uses twenty-two to twenty-five amperes per square foot on both his copper and his nickel.

DELEGATE HANLON: Mr. Hermansen, is it not a fact that some large concerns are now using a little glycerine with their glue, to be able to use their wheels much faster and dry them a little artificially?

MR. HERMANSEN: Yes. I know that two years ago the Devine Manufacturing Company installed quite a pretentious layout in our plant for drying wheels, and they advocated using a little glycerine in the wheels so that they could dry them faster. The glycerine would retard the cracking action of the glue.

BALTIMORE - WASHINGTON BRANCH

BALTIMORE-WASHINGTON BRANCH

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New Howard Hotel
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Saturday, February 2, 1935
Dinner at 6.30 P. M.

See Branch News for Program

Tickets $1.25 each

BALTIMORE-WASHINGTON BRANCH

BALTIMORE - WASHINGTON BRANCH

Silver Deposit on Glassware

By GORDON GILES
Member Toronto Branch

Read at Toronto Branch

GLASS to be silver deposited is first washed in an alkali cleaner to make sure it is free from all grease and oils. The glass is then decorated with a very fine silver paint. This paint is composed of a precipitated silver powder, flux, (which is a very finely ground soft glass) and a vegetable oil. This mixture is then ground for a period of two weeks in a mill with stone pebbles. The pattern to be used is etched into a steel plate and then the same paint with wax added is spread into the etching. To take the pattern from the plate a piece of tissue paper is placed over same and a hand roller used to release the transfer.

After the glass has been decorated it is fired in a furnace for eight hours. This softens the glass and the flux which has been added to the paint being of a softer composition than the glass itself melts first and adheres to the surface. The oil used being a vegetable oil burns away. The glass is now ready for plating.

The plating of the glass is a very slow process. It is done by the use of storage batteries of a very low voltage and amperage ($1\frac{1}{2}$ volts and 1 to $1\frac{1}{2}$ amps. per square foot). The solution used is high in metal and low in cyanide. The content being 6 oz. silver and $\frac{1}{2}$ to 1 oz. free cyanide per gallon. After the plating the article is scratch-brushed to get the white off the surface. If not taken off the buff wheel will burn it in and cause a grayish or dull finish. Care must be used in brushing the glass not to use a hard brush. The deposit being soft will show a brush mark.

The deposit is governed by the size of the grains of the silver powder used in the paint. A large grain will give a very rough and hard deposit which makes it difficult to produce a bright finish. A small grain will bring a smooth deposit.

Deposit on celluloid is of the same principle. A solvent is used to soften the celluloid and when the surface becomes sticky silver powder is dusted on the softened portion and left to dry. As it dries the celluloid hardens and the silver adheres to it. It is then

plated in a higher amp. and voltage solution to the desired thickness and then brushed and polished in the same way using a green rouge on account of the heating in polishing.

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Program, George Knecht, 132 West Elm St., New Haven, Conn.
Visitations, John Oberender, The Zapon Co., Stamford, Conn.
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Hotel LaSalle
Saturday, January 19, 1935

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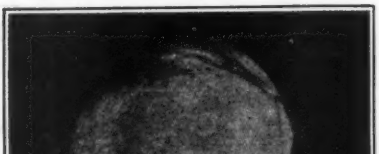
A Hearty Welcome to You

Dr. William Blum



Dr. William Blum of the Bureau of Standards, and one of the outstanding leaders in the American Electro-Platers' Society, has been invited to participate in the Faraday Society's Symposium on the "Structure of Metallic Coatings, Films, and Surfaces" in London, March 29 and 30.

Dr. Blum and Dr. Charles Kasper of the National Bureau of Standards are preparing a paper upon the structure of nickel deposits. This paper, it is expected, will be presented by Dr. Blum in person. He also plans to attend meetings of the Electrodepositors Technical Society in Birmingham and London. In connection with the electrodeposition of metals Dr. Blum will spend about a month in visiting plants and research laboratories in England, France, and Germany.

The news of this high honor will be received with the greatest degree of satisfaction by the members of the American Electro-Platers' Society. Dr. Blum has been for years one of the most prominent figures in all the activities connected with our organization, especially in the aims and ideals of the Research and Educational Committees. At the annual meetings his enthusiasm has been an inspiration and his counsel safe and sure.

Our best wishes go with him to the "other side" where he is well known and where a good reception is assured in each country he visits. We express the feelings of our entire membership when we say "Bon Voyage", Doctor, and a safe return refreshed in mind and body

Status of Joint Researches on Electroplating

By DR. WILLIAM BLUM
National Bureau of Standards

IT is felt at this time that a report of the activities of the Research Committee should be published. To this end Dr. Blum has supplied a report which was sent to those who represent the A. S. T. M. and the related Joint Committees. This embodies the main part of the report.

I feel that everyone should be interested in the drive for funds which will start January 1st. A considerable amount of preliminary work has been done on this, the Chairman having broken the Committee up into sub-groups augmented by appointments in localities which are not represented. I feel, however, that every member of the Society should put his shoulder to the wheel as they have in the past, and put this fund over in the creditable manner which we all expect.

W. M. PHILLIPS, Chairman Research Committee

II. THE NEW PROGRAM

1. **Program.** Since the Tentative Program dated October 29th was distributed, a number of valuable suggestions have been received. Many of these include detailed cycles for various plating processes. These will be correlated, and a specific procedure for each plating process will be outlined, with alternate steps whenever the choice is not obvious. This detailed program will be sent to the Research and Joint Committee for comment and approval.

Other suggestions refer to the choice of base metals and of the coatings to be applied, or to the inclusion of additional sets. As there are only 10 blank spaces in the present program, it is obvious that the inclusion of more than 10 additional sets will necessitate elimination of others. In the near future all these suggestions will be compiled for committee consideration, in such a way that the members may clearly indicate which additional sets and which omissions they approve.

2. **Materials.**--

(a) *Plating Supplies*—As it takes some time to arrange for and have delivered, all the required materials, inquiries were started some weeks ago. As a result, the following chemicals and anodes have been donated without expense, by the firms indicated:

Plating Supplies

Material	*Amount*	*Firm*
Chromic acid	400 lbs.	Mutual Chemical Company
Sodium cyanide	200 lbs.	R. & H., Dupont Co.
Copper cyanide	100 lbs.	" "
Copper sulphate	200 lbs.	Grasselli Chemical Company
Sodium sulphate	400 lbs.	" " "
Nickel sulphate	400 lbs.	Harshaw Chemical Co.
Nickel chloride	100 lbs.	" " "
Anode bags	24	" " "
Nickel anodes	480 lbs.	International Nickel Co.
Buffing Compounds	110 lbs.	Hanson-Van Winkle-Munning Co.
Buffs	55	" " "

These will meet the approximate needs, regardless of the exact program. The thanks of the Committee have been expressed to these firms.

(b) *Base Metals*—Various firms have agreed to furnish the base metals, in accordance with the following list. The requested amount of each of these is sufficient to meet moderate additions to the program. If other base metals are decided upon, they will be requested later.

Base Metals

Metal	*Approx. lbs.*	*Firm*
Steel		
Cold rolled	500	American Steel & Wire Co.
Cold rolled (special)	30	Through G. B. Hogaboom
Spring	200	General Spring Bumper Co.
Iron		
Gray Cast	200	American Stove Co.
Malleable	200	National Malleable & Steel Castings (Polishing to be arranged).
Copper, rolled	100	Revere Copper and Brass Co.

Brass		
Cast high	500	Yale and Towne Mfg. Co.
Cast low	200	Sargent Co.
Extruded	200	Scovill Manufacturing Co.
Rolled high	300	Chase Companies
Rolled low	75	Bridgeport Brass Co.
Rolled Ni Brass	125	American Brass Co.
Cast Ni Brass	500	Standard Sanitary Co.
Metal	*Approx. lbs.*	*Firm*
Zinc		
Rolled	125	New Jersey Zinc. Co.
Die Cast XXI	500)	N. J. Zinc Co. and Doehler Die
Die Cast XXIII	2000)	Casting Co.

(c) *Equipment*—The equipment of the Bureau has been overhauled and it is believed that it will be adequate for the new program.

(d) *Plans*—Just as soon as the cold rolled steel is received, probably before January 1, 1935, the plating of the steel specimens to duplicate previous sets will be started. It is not feasible to make up the plating solutions much in advance, because the tanks and generator will be required for other work until the new program is started.

(e) *Assistance*—So much time will be required for cutting and marking specimens, and buffing the plated coatings, that Mr. Strausser alone cannot make rapid progress in the plating. It is not possible with the present Bureau staff and funds to give him continuous assistance. It is therefore hoped that sufficient funds will be collected by the Research Committee very soon, to not only insure Mr. Strausser's salary, but also to provide a helper at not more than $100 per month for at least one year. (This is included in the budget of $5000 per year.)

III. SPECIFICATIONS

The specifications have been revised in the light of the conference on September 26 and again circulated for comment. About December 15th, these comments will be compiled so that the joint specification committee can decide all major questions. As soon thereafter as possible these specifications will be submitted to the A. S. T. M. and A. E. S. for formal consideration.

The proposed specifications for nickel, chromium, zinc and cadmium include requirements as to minimum thickness of deposits. During the past two months Mr. Strausser has spent much time on "dropping methods" for measuring the local thickness of zinc, cadmium and chromium coatings. The results indicate that with proper standardization of the solutions and conditions, this method may be used for zinc and cadmium with an accuracy of at least +15%. The results with chromium, especially with the proposed minimum of 0.00001 inch, are erratic, and it remains to be seen whether, before testing, the chromium surfaces can be put in active condition, so that concordant results will be obtained. Unless this is accomplished, it will be necessary to confine the specifications for chromium to the average instead of the minimum thickness. It is fortunate that the unavoidable delay in starting the new program permitted Mr. Strausser to test these methods, as such knowledge is fundamental for the specifications.

Your Chairman has also been appointed Chairman of a subgroup of the A. S. T. M. on methods of test for plated coatings. This Committee is assembling all methods now in common use and A. S. T. M. will publish a resume of this data when it is completed.

IV. PUBLICATIONS

The results of the exposure tests of nickel and chromium plating on steel were published as Research Paper 712 in the Journal of Research for September, 1934; and of the Accelerated Tests as Research Paper 724 in the October Journal of Research. The Research Committee has purchased 1500 copies of each of these papers (at $3\frac{3}{4}$ cents each, including mailing). Copies of R.P. 712 have just been sent to all the members of the A. E. S., and cooperating firms and committees; and copies of R.P. 724 will be similarly distributed as soon as they are available.

A third paper, on methods of determining the thickness and distribution of plated coatings, will be prepared as soon as the present study of dropping methods is completed, and will be distributed when printed.

V. CIRCULATION OF PLANS AND REPORTS

The complete mailing list of the section includes about 250 persons or firms, being made up of the A. E. S. officers, branch

secretaries, and research committee; firms that have donated money or materials for this project; joint committees of the A. E. S. and A. S. T. M.; interested officers and members of the A. S. T. M.; and numerous manufacturers and others who have expressed an interest in this work. The proposed specifications and the new program have been distributed to all these persons, but comparatively few comments have been received except from committee members. Now that these persons have had an opportunity to comment, it is suggested that the revised specifications and program be sent only to the committee members and to those others who have submitted comments, for further comment or approval. This will avoid the delay of waiting for replies from a large number of persons.

Every effort will be made to expedite each of the above activities as much as the available funds and personnel will permit.

Supreme President Gilbertson appointed all Branch Secretaries as members of the Membership Drive Committee. On page 63 of this issue is a tabulated statement showing the standing of each Branch for a period of three months, and from reports received only 13 are standing.

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Accelerated Tests of Nickel and Chromium Plating on Steel

By Paul W. C. Strausser, Abner Brenner and William Blum

Research Paper R P 724 from the *Journal of Research of the National Bureau of Standards, Oct. 1934*

PLATED specimens similar to those used in atmospheric exposure tests were subjected to accelerated tests, especially by means of a salt spray and by intermittent immersion in a salt solution. The time required for the first appearance of slight rust in these tests was not consistent and had no direct relation to the protective value of the coatings. When the extent of rust at the end of a definite period, for example 100 hours, was recorded, the results were approximately parallel to those of atmospheric exposure. The protective value of a metallic coating of this type depends principally upon its freedom from porosity. The latter can be determined in a few minutes by the ferroxyl test.

I. INTRODUCTION

In a previous paper, the results of extensive exposure tests of nickel and chromium plating on steel were reported. That information is valuable in the selection and specification of the kind and thickness of plating for any given type of service. With adequate control and supervision, any given requirements for thickness can usually be met by a manufacturer or plater in his own plant. In such cases, however, it is desirable to have rapid methods of test to check the quality of the plating. Such tests are even more useful when parts are sent out to be plated, or plated parts are purchased, as then it is not usually practicable for the purchaser or user to check the time and current density employed in the plating operations.

The above exposure tests furnished a good opportunity to determine the relation between various accelerated tests and the behavior of the coatings under various atmospheric conditions.

The specimens used in this investigation were a part of those plated for the exposure tests. They will be referred to by number, with sufficient description for their identification. For details of their preparation the previous paper should be consulted.

II. ACCELERATED CORROSION TESTS

The purpose of an accelerated corrosion test is to determine, in a short time, at least the relative value of different coatings under conditions likely to be encountered in service. The latter are, however, so varied that it is practically impossible to introduce all factors into an accelerated test, much less to control their relative effects. In general, therefore, it is preferable and customary to employ a simple test such as (a) exposure to a fine spray of sodium chloride, commonly known as a salt spray test, or (b) immersion in a corrosive solution, for example, intermittent immersion in a sodium chloride solution.

The principal substances that are likely to cause or accelerate corrosion of steel in the atmosphere are oxygen, water, carbon dioxide, sulphur dioxide and trioxide, and sodium chloride. The first three substances are always present, but generally their effects are slow and not directly susceptible of great acceleration. The sulphur compounds are found in urban and industrial atmospheres, and sodium chloride is present in marine exposures.

Various efforts have been made to introduce sulphur dioxide into simulated but accelerated atmospheric tests. The results here and elsewhere have shown that low concentrations of sulphur dioxide (0.1 to 1 percent), especially when continuously present, exert solvent effects on the coatings that are entirely unlike the effects of industrial atmospheres that contain fluctuating and much smaller concentrations of sulphur compounds. Sodium chloride has therefore been most extensively used in accelerated tests. It might be predicted, and has been approximately confirmed, that the results are at least similar to those obtained in a strictly marine exposure. The increased rate of corrosion is obtained partly by the use of high concentrations of sodium chloride and partly by the more severe conditions under which it is applied.

Another factor that can be varied to accelerate the corrosion is the temperature, which, however, should not be so high as to change the nature of the corrosion processes. As a temperature

of 35° C (95° F) is often reached naturally, even in temperate climates, it was selected for use in the salt spray and intermittent immersion tests, which were carried out in a room with thermostatic control. Tests made at "room temperature" are subject to uncertainty through the fact that in uncontrolled rooms the extreme temperature at various seasons may range from 10° C (50° F) to 35° C (95° F). The latter temperature was selected because it is about the lowest that can be maintained throughout the year without artificial cooling.

Before applying any accelerated test to plated metals, the surface should be thoroughly cleaned in order to permit uniform access of the reagent to the surface. A simple test for cleanness is that the surface shall be uniformly wet with water, that is, there shall be no "water-break." The cleaning was accomplished in these tests by rubbing with cotton or cloth moistened with a thin paste of pure, fine magnesium oxide. Vapor cleaning with a suitable solvent is effective, but less convenient for laboratory testing.

1. Methods

The salt spray and intermittent immersion were applied to most of the nickel and chromium finishes under the following conditions.

(a) Salt Spray

The salt spray test was conducted with a 20 percent solution of pure sodium chloride in a room kept at 35° C (95° F). The nozzle, air pressure, and baffle were so adjusted as to keep a uniform fine mist throughout the box and to wet uniformly the specimens, which were placed at an angle of 45° from horizontal. The solution that was condensed from the spray was drained off and not used again. The specimens with buffed nickel and chromium coatings were painted on the edges with a bituminous paint to prevent formation of rust there, which might run over the surface.

The specimens were inspected at the end of the first 6 hours and of each 24-hour period. At each inspection, they were washed lightly with running water and the number of rust spots on each specimen was noted. In addition a rating of from 5 to 0, on the same basis as the exposure ratings, was given to each specimen. If, at the end of a definite period such as 100 hours, the corrosion was so pronounced that rust spread over the

surface, the latter was cleaned by light rubbing with magnesium oxide paste, rinsed, and returned to the salt spray for 4 hours. This served to bring out the spots clearly without much spreading of the rust.

(b) Intermittent Immersion

The intermittent immersion tests were also conducted with a 20 percent solution of sodium chloride. Each cycle included 1 minute in the solution and 14 minutes in air. The temperature was kept at 35° C (95° F) and the relative humidity at 60 ±5 percent. This constant humidity insured a uniform tendency of the specimens to dry during the air exposures. Under these conditions they were visibly wet for about one-half the period in the air. The specimens were inspected at the same intervals as in the salt spray and the condition of each was similarly recorded.

2. Results

The results of the accelerated tests may best be considered by comparing them with those of the atmospheric tests. The latter data in table 1 are based on 18 months' exposure. At Key West and Sandy Hook, the corrosion was more severe than at State College and Washington, and more easily rated than at New York and Pittsburgh.

TABLE 1.—Porosity and accelerated tests on nickel and chromium finishes

(a) Nickel

Set number	Total thickness	18 mo. atm ex. score			Ferroxyl Test Number of spots	Salt Spray				Intermittent immersion			
		KW SH	NY P	SC W		First rust	Spots at 100 hr	Rating at 100 hr	Corresponding score	First rust	Spots at 100 hr	Rating at 100 hr	Corresponding score
	In.	*Percent*	*Percent*	*Percent*		*Hr.*			*Percent*	*Hr.*			*Percent*
52	0.00025	10	13	33	100	6	80	2	40	6	40	3	60
5	.0005	26	25	76	12	12	20	3.5	70	30	4	4	80
1	.001	65	52	87	3	20	5	4	80	30	2	4	80
6	.002	79	69	95	3	70	1	4.5	90	80	2	4.5	90
						(b) Nickel, Copper, Nickel							
53	.00025	4	13	15	200	6	100	1	20	6	100	1	20
15	.0005	13	3	81	40	6	70	2.5	50	25	35	3.5	70
13	.001	49	47	92	2	20	15	4	80	25	8	4	80
16	.002	69	65	99	0	6	10	4	80	75	2	4.5	90

(c) Nickel, Chromium

152	.00025	9	20	51	80	15	100	2.5	50	50	35	3.5	70
105	.0005	10	20	72	20	25	25	3.7	70	65	2	4	80
101	.001	51	46	100	2	50	10	4	80	90	1	4.5	90
106	.002	80	84	96	0	55	1	4.5	90	85	0	4.5	90

(d) Nickel, Copper, Nickel, Chromium

153	.00025	10	19	42	100	15	100	2	40	40	60	3	60
115	.0005	15	26	88	8	15	60	3	60	35	25	3.5	70
113	.001	36	39	98	2	15	20	4	80	40	25	3.5	70
116	.002	79	57	100	1	6	3	4.5	90	65	15	4.5	90

Per specimen on 1 side, having an area of approximately 1.5 dm^2 or 1/6 ft^2.

(a) Salt Spray

The results of this test are most commonly reported in terms of the period required for the initial appearance of rust. There is, however, considerable latitude in judging the amount of rust that constitutes failure in this test. Some define it as rust plainly visible at a distance of 3 feet. Others simply disregard what they consider to be very small rust areas. In this study, any rust visible to the unaided eye at a distance of 12 to 18 inches was recorded. The number of rust spots was noted at intervals, and a rating was also given according to the scale used in the atmospheric tests.

The results in table 1 show that, as defined by us, the first appearance of rust has no direct relation to the quality of the coating. For example, in (b) and (d) a slight amount of rust appeared in 6 hours on very thick deposits (nos. 16 and 116), which were known to have good protective value in the atmosphere. The individual results are even more erratic than shown in table 1, which presents the averages of 3 specimens. It was not unusual for slight rust to appear on one specimen in 6 hours and on another of the same set in 50 or 100 hours.

If, however, the number of rust spots is recorded at the end of a definite period such as 100 hours, the results in the salt spray are very similar to those of the ferroxyl test to be described later. Apparently, the salt spray merely detects pores, but requires 24 to 100 hours, instead of the 5 or 10 minutes required for the ferroxyl test. In general, the ratings at the end of 100 hours correspond inversely to the number of spots at that time. It is therefore suggested that in the salt-spray test greater attention be paid to the number and size of the spots after a definite interval than to the time of their initial appearance.

As the salt spray test is sometimes conducted with a dilute salt solution, and is almost always conducted without control of temperature, a few tests were made to determine the effects of concentration and temperature. The results, not recorded in table 1, may be summarized as follows:

With a *N* solution of sodium chloride (about 5.5 percent NaCl), the rate of failure of nickel and chromium plated steel was much slower than in a 20 percent solution. In general at 22° C (72° F) it required about 72 hours in the dilute solution to produce the same corrosion as appeared in 24 hours in the 20 percent solution.

The effect of temperature was more marked during the first part of the test period than during longer periods. For example at approximately 22° C (72° F) it required about 48 hours to produce the same corrosion as appeared in 24 hours at 35° C (95° F). However, at the end of 100 hours there was not much difference in the amount of rust produced at the 2 temperatures. It is apparent therefore that the customary definition of failure in terms of the time required for the first appearance of rust requires even closer control of temperature than when the extent of rust at the end of a longer period is estimated.

Any ratios based on the above tests are only approximate, and are useful merely for showing the direction and magnitudes involved, and not for making corrections for variations in temperature or concentration. Consistent results can be obtained only at a controlled temperature, for which 35° C (95° F) is the lowest practicable without artificial cooling.

(b) Intermittent Immersion

The results of the intermittent immersion are very similar to those of exposure to salt spray and are subject to the same limitations. The periods for the first appearance of rust are somewhat longer, but more consistent than in the salt spray. The number of spots developed in 100 hours is usually less than in the salt spray. There does not appear to be any marked advantage in using the intermittent immersion test instead of the salt-spray test for nickel and chromium finishes.

(c) Relation to Atmospheric Exposure

When the rating or number of spots after 100 hours in noted, both the salt spray and intermittent immersion tests place the sets of each group in the order of thickness, that is, in the same order of quality as in the atmosphere. They are therefore useful

in distinguishing between good and poor coatings, even though the size, color, and distribution of the rust spots are not very similar to those in even a marine atmosphere, much less in an industrial atmosphere.

These two tests do not generally serve to detect small differences in protective value, which in turn are not usually consistent in different types of exposure. However, they both showed (in tests not recorded in table 1) the superiority of nickel finishes applied over a buffed copper layer to those over unbuffed copper, which difference was also reported in the atmospheric tests. This effect was not observed when chromium was also present.

An example of misleading results in the salt spray and intermittent immersion tests is the fact that composite coatings of cadmium, copper, and nickel (set no. 25) failed very rapidly in both tests, but not in either a marine or an industrial atmosphere. When chromium was applied over the nickel (set no. 125), no marked failure of the composite coating was observed in either the accelerated or atmospheric tests.

III. POROSITY TESTS

Both the exposure tests and the accelerated tests showed clearly that the protective value on steel of coatings consisting of the more noble metals, such as copper, nickel, or chromium, depends almost entirely on their freedom from porosity, while that of less noble metals such as zinc and cadmium is approximately proportional to the minimum thickness. If it were possible to produce absolutely impervious coatings of the first group, especially of chromium, they would furnish permanent protection in most climates. Apparently the only practical method of approaching this goal is to make the deposits thicker, and even this method is not certain for chromium. Reliable tests for porosity may therefore be very useful for inspection, as they require much less time than the usual accelerated corrosion tests.

1. In Nickel Coatings

(a) On Steel

Ferroxyl test.—This well-known test is applicable for detecting pores in any metallic coating on steel that is more noble than the steel. It depends upon treating the surface with a solution containing an agent, usually sodium chloride, that will attack steel but not the coating, and a substance that will react visibly

with iron compounds. A ferricyanide solution is used, as it produces blue spots with any ferrous salt formed by the action of the sodium chloride on exposed steel. The mixed reagent may be applied as an aqueous solution, or one containing a gel (such as agar) that will form a congealed film, or in paper saturated with the reagent.[3] As the latter method yields a permanent record, it was employed in this investigation.

A study of this method showed that the concentration of the sodium chloride is not critical, though stronger solutions accelerate the attack of exposed steel. The concentration of ferricyanide should, however, be kept as low as possible and still yield blue spots. In high concentrations, the ferricyanide attacks nickel appreciably, especially in the presence of sodium chloride, and may therefore produce pores where the nickel is originally thin but not porous.

The most consistent results were obtained under the following conditions. The liquid reagent contained 60 g/l of sodium chloride and 0.5 g/l of potassium ferricyanide. For making the ferroxyl paper, 10 g/l of agar was dissolved in this warm reagent, and a 50 percent white rag bond paper was soaked in it and allowed to dry. The plated surface was cleaned by rubbing with fine magnesium oxide and water, and rinsed, after which it was immersed in the ferroxyl solution without agar for 5 minutes. The paper was then moistened, pressed on the surface, and removed after 5 minutes. The number of blue spots, excluding those within 0.25 in. of the edge, was recorded.

As shown in table 1, when the ferroxyl test is applied to coatings consisting of copper, nickel, or chromium on steel, the porosity roughly corresponds (though inversely) to the thickness of the coatings and to their percentage scores in the exposure tests. The method serves to detect marked differences in porosity, such as are commonly observed on coatings of different thicknesses, but cannot be used to predict the small differences in behavior of specimens with the same thickness but with different composition. Just as with the above-described accelerated tests, it is difficult to incorporate the ferroxyl test into a specification because the value of the coating depends on the size of the pores as well as their number. The method is therefore chiefly of value for factory inspection of similar coatings and articles.

[3] Pitschner, K., Proc. Am. Soc. Testing Materials [II], 27 304(1927).

(b) On Copper

In most cases it is necessary to detect only those pores which extend through to the steel, which can usually be done with the ferroxyl test. Occasionally, however, it may be desirable to study the porosity of the separate layers, and especially of the outer nickel layer, in composite coatings that include a layer of copper.

Sometimes when the ferroxyl test is applied to composite coatings with an intermediate copper layer, red spots appear. These are caused by copper ferrocyanide, and their detection can be facilitated by adding a small amount, such as 1 g/l, of ferrocyanide to the ferroxyl reagent.

Another method that yields fair results is to immerse the specimen in hydrogen sulphide water. Black spots appear where any appreciable area of copper is exposed, but fine pores are not readily detected.

(c) On Zinc or Cadmium

It was found that by treating the surface for about 30 seconds with a solution that contained sulphuric acid (N, 49 g/l H_2SO_4) and copper sulphate (0.08 N, 10 g/l $CuSO_4.5H_2O$), copper deposited wherever zinc or cadmium was exposed. The presence of the copper was more readily detected by subsequently immersing the specimen in water saturated with hydrogen sulphide, which produced black spots. Any large pores or unplated areas were readily revealed, but the detection of fine pores was uncertain.

2. In Chromium

The methods for detecting pores or cracks in chromium coatings were fully described in a previous publication. The copper deposition test, which depends upon the fact that copper is deposited only in pores or cracks in the chromium, was then found to be most reliable. When applied to various deposits used in this investigation, the results were consistent with those previously reported. This is important in view of the fact that some of the results of the exposure tests did not correspond with the predictions made on the basis of the porosity of the chromium coatings.

IV. CONCLUSIONS

Both the salt spray and intermittent immersion tests are useful for determining the relative quality, and especially the porosity, of coatings consisting of copper, nickel, and chromium.

The results are more significant and more closely related to those of atmospheric exposure if the number and size of the rust spots at the end of a specified period, such as 100 hours, are recorded, rather than the time for the first appearance of rust. These methods do not, however, closely reproduce the types of corrosion produced in the atmosphere, and do not serve to detect small differences in protective value. The ferroxyl test is a rapid, reliable method for determining the relative porosity of the coatings.

BOOK REVIEWS

Chromium Plating with Special Reference to its application in the Automobile Industry. By - E.H.O. Bauer, H. Arndt, W. Krause, M. Krayer, Berlin, Publisher, 1934.

Analyses of coating thickness are given of various plates on different basis metals, which enable us to compare German and American practice. The coating thicknesses of German technique are mostly thinner than those used in the United States. For nickel chrome plating on steel, the averages are Ni .00015", Cr .000015". For plating on zinc die castings, copper flash plates are most commonly used.

The subject headings are thickness measurements, reflectivities, adhesion, resistance to deformation, hardness, ease of polishing, temperature resistance, diffusion, vapor pressure, porosity tests, corrosion tests against weather, sea water, polishing materials, oils and fats, results of corrosion tests on parts plated in industry, potential measurements and a grand summary. This report may be compared with the work on plating thickness on steel just finished by Dr. Blum and his associates.

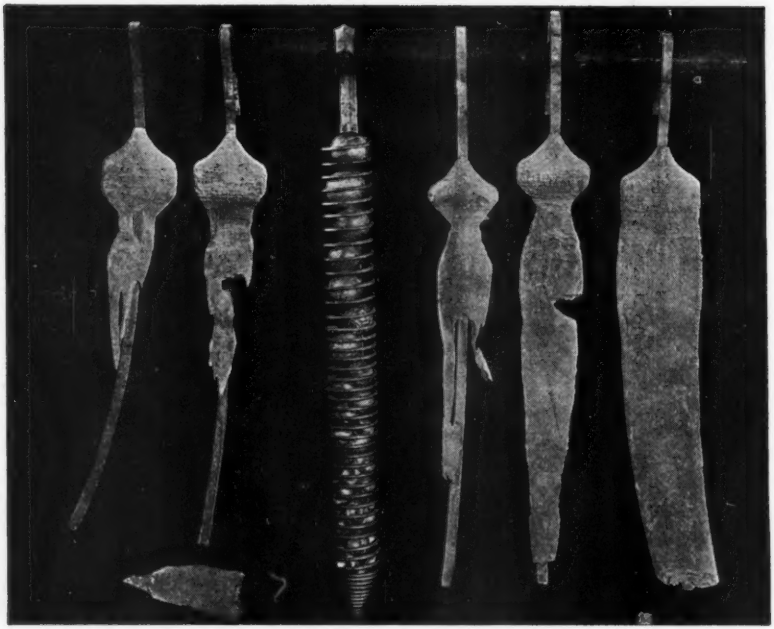
W. R. MEYER

Chromium Plating - Its Mechanical Applications.

Machinery's Yellow Back Series. 5. 54 pp. The Machinery Publishing Co., Ltd. London, 1934. 2/6d, about 65 cents). This booklet is a very useful compilation of the mechanical applications of chromium plating, that will be valuable to every person who has occasion to consider such problems. It gives typical results obtained in various applications, such as on gages, reamers, drills, milling cutters, lathe tools, woodworking tools, dies, rolls, bearing parts of machinery, and printing plates.

Precautions required to secure uniform distribution are clearly explained, and the operation of the baths is described, as well as the physical properties of chromium. The discussion of the bath composition, temperature and current density is less specific than would be necessary to permit a reader to duplicate any set of conditions. American readers should note that (presumably) the concentrations are given in ounces per Imperial gallon (although the reference to Sargent corresponds to ounces per U. S. gallon).

While many of the statements are qualitative and subject to valid differences of opinion, the book is almost free of specific errors. One apparent mistake is a reference (p. 49) to the use of a chromium wire as the anode in plating rifle barrels. In the reviewer's opinion it is more probable that the resistance of chromium to wetting and to adhesion to metal surfaces, is caused by the passive oxide film rather than by "the high surface energy of chromium" (p. 22). WILLIAM BLUM.



The ball anode is here compared with the usual slab anode. Various stages of disintegration of the slab anode are shown. As these corrode, the area decreases, thus disturbing the metal content of the bath. Chunks of cadmium metal fall from the straps to the bottom of the tank where they are useless as anode material. On the other hand, the helical coil anode, consisting of pure cadmium balls, corrodes evenly. As the diameter of the balls diminishes, they descend in the wire container and fresh balls are added at the top.

BALL ANODE PATENTED

U. S. Patent Reissue 19328 covering ball anodes for electroplating and containers for same has recently been granted by the United States Patent office. Through this new patent, The Udylite Company, Detroit, Michigan, now has exclusive rights to manufacture, sell and use ball and spheroidal anodes for electroplating.

The Udylite Company first introduced ball anodes to the plating industry as part of the Udylite Process of cadmium plating several years ago. Now most of the firms engaged in cadmium plating have switched to ball anodes. The popularity of this type anode is spreading from cadmium plating to include other electroplating processes such as copper, zinc, tin, etc.

The features of the ball anode are several. One of the most important is the maintenance of constant anode area at all times. This makes it possible to keep the metal content of the plating bath constant without the necessity of expensive salt additions.

Another important feature is the elimination of scrap metal losses. As the ball anodes corrode, they diminish in diameter and descend in the container. Fresh balls are added at the top. Even the smallest scraps of anode material are completely used up in contrast to the bar or slab type anode, the use of which entails appreciable scrap losses.

Principles of Chemistry

For ELECTROPLATERS

INTRODUCTION

IN connection with classes on the analysis of plating solutions and with discussions of plating problems, it is continually necessary to make use of the terms and principles of chemistry, with which many of the platers are not entirely familiar. The only way to gain such familiarity is to frequently discuss and explain these principles. The Educational Committee therefore suggests that whenever the program permits, at least a half hour be devoted in each regular branch meeting to such discussions.

As a basis for this program, Dr. William Blum has prepared outlines of six lessons, the first of which is published in this number of the REVIEW, to be followed by one each month. These are given merely in outline form in order to stimulate thought and discussion, and an opportunity for illustrations of local interest. It is suggested that each branch designate a member who is a chemist or has considerable chemical knowledge, to lead these discussions and to explain and illustrate the principles. If each member will attempt to work out the problems in advance, the answers can be discussed in the class, and errors corrected by the leader. If the lesson cannot be fully covered in one meeting, time in two or more meetings may be devoted to it.

The Educational Committee will be glad to receive comments from branches that follow this plan, suggestions for improving it, and questions regarding any difficulties experienced with it.

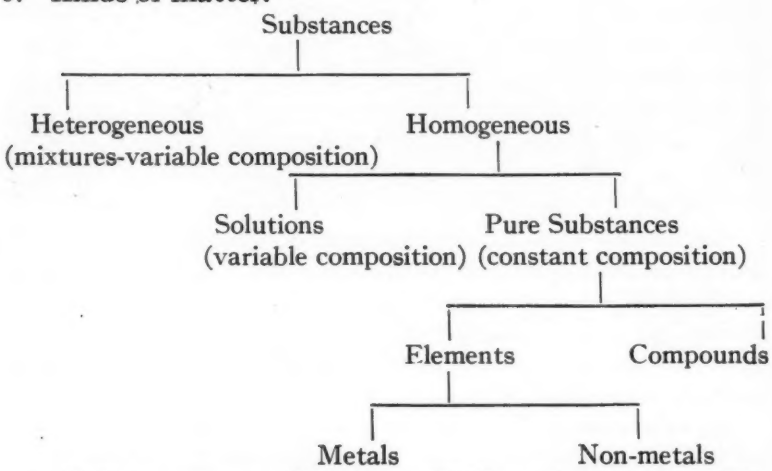
T. F. SLATTERY, *Chairman*
Educational Committee

LESSON I
Matter

1. **Matter.**—Occupies space. Can be weighed and measured.
2. **Substance.**—A kind of matter, identified by properties.
3. **States of matter.**—Solid, liquid and gas. Most substances can exist in any of the three states, depending on temperature and pressure. Change from solid to liquid occurs at *melting point*; from liquid to gas (at atmospheric pressure) at *boiling point.*

4. **Properties.**—Characteristics of matter, which depend on its state.
   (a) *Physical properties.*—Exhibited without any change in the composition. For example color, luster, etxture, taste, odor, feel, specific gravity, melting point, boiling point, hardness, strength, ductility, conductivity of heat and electricity, viscosity, plasticity, solubility without decomposition.
   (b) *Chemical properties.* — Exhibited in connection with changes in composition. Combustibility, decomposition on heating, solubility with decomposition, reaction with other substances, effect of electrolysis.

5. **Kinds of matter.**—



   (a) Homogeneous substances. (Uniform throughout.)—Elements, compounds, true solutions.
   (b) Heterogeneous substances. (Not uniform throughout). Mixtures. For example most rocks, some alloys, and turbid or colloidal solutions.

6. **Structure of matter.**—
   Atom, the primary unit of which elements are built.
   Electrons, the unit of negatively charged matter contained in atoms.
   Proton, the unit of positively charged matter contained in atoms.
   Molecule, a group of like atoms present in elements, or of unlike atoms present in compounds.

7. **Changes in matter.**—
   (a) *Physical changes.*—Temporary. Do not change the composition.
   (b) *Chemical changes.*—Permanent. Change the composition.
      (1) Combination
      (2) Decomposition
      (3) Double decomposition
8. **Conservation of matter.**—Matter can be neither created nor destroyed.

Problems.—Lesson I.

Note.—First attempt to answer these questions without any assistance or reference to books. Then, if necessary, obtain such aid and put the latter answers in parentheses.

1. Suppose you knew (or suspected) that the contents of five unlabeled boxes containing white powders were (a) fine quartz sand, (b) powdered sugar, (c) calcium carbonate (whiting), (d) sodium hydroxide (caustic soda) and (e) sodium cyanide. How would you positively identify them?
2. Suppose that through an accident some fine rouge was introduced into a barrel of nickel sulphate. How would you recover the nickel sulphate in sufficient purity to add to a bath?
3. Indicate by a check mark the proper classification of the following substances:

	Element	Compound	Solution	Mixture
(1) Charcoal				
(2) Copper sulphate				
(3) Lead				
(4) Chromic acid				
(5) Tripoli paste				
(6) Graphite				
(7) Silver				
(8) Brass				
(9) Air				
(10) Water				
(11) Sea water				
(12) Alcohol				
(13) Steel				
(14) Paraffin				
(15) Milk				

4. Indicate characteristic properties of the following substances:

	Color	Relative Specific Gravity	Soluble in	Combustible in air?	Other Properties
(1) Nickel					
(2) Sulphuric acid					
(3) Sulphur					
(4) Grease					
(5) Rouge					
(6) Copper carbonate					
(7) Nickel carbonate					
(8) Zinc					
(9) Pitch					
(10) Boric acid					

5. Classify the changes in the following operations:

	Physical	Chemical
(1) Drying of lacquer		
(2) Drying of varnish		
(3) Sparking in grinding metal		
(4) Buffing metal		
(5) Copper plating		
(6) Forging metal		
(7) Crystallizing copper sulphate		
(8) Passage of current through rheostat		
(9) Magnetizing steel		
(10) Pickling steel		

The committee is pleased to advise our members that Mr. E.T. Candee, Technical Supervisor, American Brass Co., has kindly consented to abstract for our columns from the following journals:

Iron Age, Metal Progress, Steel, Mining - Metallurgy, Zeit Metallurgie, Trans. A. I. M. E., Metal Cleaning & Polishing.

As it has been impossible for the Editor to arrange an exchange with some of the foreign journals, arrangements have been made by the committee for the purchase of the following:

(1) *Oberflachentechnik* (2) *Deutsche Goldschmiedezeitung*
(3) *Metallwaren Industrie u Galvanotechnick.*

The Abstract Section

T. F. SLATTERY, *Chairman, Program and Educational Committee*

Automatic Devices in the Chrome-Plating Industry. *Engineering Progress*, **15,** 163; 1934. (This Journal is published in Germany but is printed in English). — A very general description of chromium plating is given, with illustrations (but few details) of equipment for chromium plating in (a) still tanks, (b) a semi-automatic circular tank, (c) a full automatic conveyor tank, and (d) a plating barrel. No data are given on solution composition or current density. W. BLUM

Hard Facing, Inserts and Plating Satisfy Hardness Requirements. (Part II). ALLEN F. CLARK, Machine Design, **6,** 30-4, July, 1934. — Part II describes some of the mechanical applications of chromium deposits, which are introducing a new field of activity for the plating industry. The hardness, wear and corrosion resistant properties of chromium are utilized by proper application directly on machined steel surfaces. Electrodeposited chromium is harder than any form of case hardened steel, is tenacious and adherent to steel, does not freeze to bearings, resists corrosion, heat, wear and abrasion, including that produced by granular substances. The base metal provides mechanical strength and the chromium plate gives hardness and wear resistance. Chromium plated water pump shafts prevent corrosion during idle periods, scoring and complete freezing to the bearing. Freezing of shafts running in zinc die-cast bearings was likewise eliminated. Piston pins in automotive engines are first lapped, then plated with 0.0002 to 0.0003 in. of chromium. Some applications of chromium plating are: textile machinery parts; ceramic sludge pump liners; blowers handling gritty substances; cylinder walls on outboard motors; steam turbine blades; oil cracking reaction chambers, stills and piping; screen plates and alkali tanks in paper industry; press plates for forming fiber board; drying, metal finishing; calendar rolls, Schreiner rolls and cloth printing rolls. R. M. WICK

Metals and Alloys in the Pulp and Paper Industry. J.D. MILLER, *Metals and Alloys*, **5,** 263-7; 1934. — The paper is a

comprehensive summary of materials of construction for the paper industry. Reference is made to the application of chromium plating to pulp screen plates, Fourdrinier suction box covers, press felt suction box covers, creping doctors and calendar rolls, which has resulted in reduced maintenance costs and frequently in an improvement in the manufacturing processes. R.M.WICK

Production of Silver-Cadmium Electrodeposits. RALPH W. HARRISON, *Deutsche Goldschmiedezeitung*, Vol. 36, Dec. 2, 1933, pages 525-526.—Discusses various essential points in obtaining good silver-cadmium platings; (1) Use of pure salts in electrolyte, (2) constant slow motion of electrolyte; with too rapid stirring, as established by practical experience, plating may become coarsely crystalline, (3) proper metal content of electrolyte: increase in Cd content of electrolyte increases Cadmium content of deposit more rapidly than corresponds to increase in electrolyte, (4) with constant silver and cadmium content in electrolyte, an increase in current density gives a higher cadmium content in deposit than corresponds to increase of current density, (5) cadmium content of deposit decreases with increasing temperature of electrolyte, but, other conditions being constant, the properties are then impaired. *M. A.* **5,** 273; 1934. G.N.

Palladium as Plating Metal in Precious Metal Industry. RALPH W. HARRISON, *Deutsche Goldschmiedezeitung*, Vol. 37, Jan. 13, 1934, pages 32-34.—One of the greatest difficulties in applying palladium as plating metal for less noble, i. e. "electropositive" metals, is tendency toward porosity. Best base metal for palladium plating is silver; copper and most copper alloys, when carefully treated, given dense deposits, whereas iron, zinc, and tin alloys must be plated first with copper or silver. Various types of palladium-plating methods with soluble and insoluble anodes are considered at length. Success depends on preparation of surfaces to be plated. Oxides, sulphides, dust, oil, etc. must be removed first. The easy removal of palladium plating is an advantage. Field of application of palladium plated parts is given. *M. A.* **5,** 273; 1934. G. N.

Silver and Gold Plating of Aluminum, Duralumin, etc. G. HUTH, *Deutsche Goldschmiedezeitung*, Vol. 37, Jan. 13, 1934,

pages 31-32.—Former difficulties in electrodepositing precious metal on light metals are eliminated by first oxidizing surface of the base metal by chemical or electrolytic methods. The natural oxide layer on aluminum is not suitable for subsequent silver or gold plating, i. e. the oxide layer must be artificially produced. Artificial oxidation of aluminum is attained by electrolyzing either in 3% oxalic acid solution or 10% chromic acid solution, or by simply chemically treating at 100°C (212°F) in aqueous solution containing 1% ammonia and 3% ammonium chloride. Parts may then be silver plated by dipping in silver nitrate solution and heating to about 160°C (320°F) whereby silver is deposited. Similarly gold platings are made. Advantage of new method is that parts may also be partially silver or gold plated. (This is not an electroplating process.) *M. A.* **5**, 273; 1934. G. N.

Prevention of Tarnishing of Silver or Silverware by Electro-Deposits. H. KRAUSE, *Deutsche Goldschmiedezeitung*, Vol. 36, Dec. 16, 1933, pages 545-548.—This article gives a chronological survey of methods used or proposed for retarding tarnishing of silverware. Palladium plating was proposed as far back as 1903 by Langbein, according to whom the best electrolyte is a solution containing palladium chloride and ammonium chloride. Siebert-Kohlweiler in 1926 used cyanide solutions of palladium. Heraeus used electrolytes containing double nitrites of the palladium metals with sodium and potassium, the process being carried on at room temperature. More recently rhodium plating has been used for this purpose because rhodium is harder than platinum and palladium and is closer to silver in its reflectivity and color. Various rhodium electrolytes are described such as those used by Cinaman, Baker & Co., and others. Chromium is also used. However, before chromium plating, the piece should first be nickel plated. The results of investigation on direct chromium plating carried on by Lehr- und Versuchsanstalt fur Galvanotechnik at Schwäbisch-Gmund were not encouraging. Protection of the base metal when chromium plated depends principally on the thickness of nickel plating. In patents of Fischbeck the use of metals is recommended whose sulphur and oxygen compounds are not decomposed by the base metal. A layer of protective metal should be thin so that the base metal shines through the plated coating. Indium was also proposed to protect silver against tarnishing. *M. A.* **5**, 273; 1934. G. N.

Prevention of the Tarnishing of Silver by Electrodeposits. H. Maka, *Deutsche Goldschmiedezeitung*, Vol. 37, Jan. 13, 1934, page 36.—In supplementing Krause's paper (preceding abstract) the author reviews results of Grube and Kosting on rhodium plating baths including solutions containing sulphuric acid, fluosilicic acid, fluoborate acid, perchloric acid, and oxalic acid. All of these baths can be regenerated by dissolving rhodium hydroxide. Chloride baths give bright deposits that are brittle. Phosphate baths that are slightly alkaline give bright, adherent deposits at 3 amp/ft², but they cannot be regenerated with rhodium hydroxide. The sulphuric acid bath is good at 70°F with a current density of 2 to 3 amp/ft² and produces bright adherent deposits with a current efficiency of from 80 to 85%. It is not sensitive to a change of composition and is easily regenerated. The perchlorate bath is rather independent of acid concentration. The fluosilicate bath gives good deposits at 4 amp/ft² with a current efficiency up to 94%. The fluoborate bath is less satisfactory. *M. A.* **5,** 273; 1934. G. N.

Wet Chromium Plating. F. DOBROVSKY. *Oberflächentechnik*, Vol. 11, July 17, 1934, pages 155-156.—Several cases were investigated of highly polished chromium plated articles which developed a kind of rusty appearance and lost their gloss. It was found that in almost all cases some chromic acid remained on the surface or that improper temperature control during plating caused the failure. Such failures were eliminated when the object was introduced into the bath while still wet after being sprayed with water. Chromium deposits made in this manner are said to resist attack of hydrochloric acid longer than deposits made in the usual manner under otherwise corresponding conditions. *M. A.* **5,** p. 572; 1934. H. A.

Prevention of Formation of Pores in Electrolytic Nickel Deposits. W. ECKHARDT, *Oberflächentechnik*, Vol. 11, Aug. 31, 1934, page 178.—It is claimed that fine-grained nickel deposits free from pores and suitable for subsequent chromium plating are obtained in a complicated bath containing nickel sulphate, nickel fluoride, sodium fluoride, sodium chloride, sodium nitrate, phenol, magnesium sulphate, sodium citrate, and boric acid. (This is a good example of a complicated bath that could not possibly be controlled by chemical analysis. W. B.) *M.A.* **5,** 572; 1934. H. A.

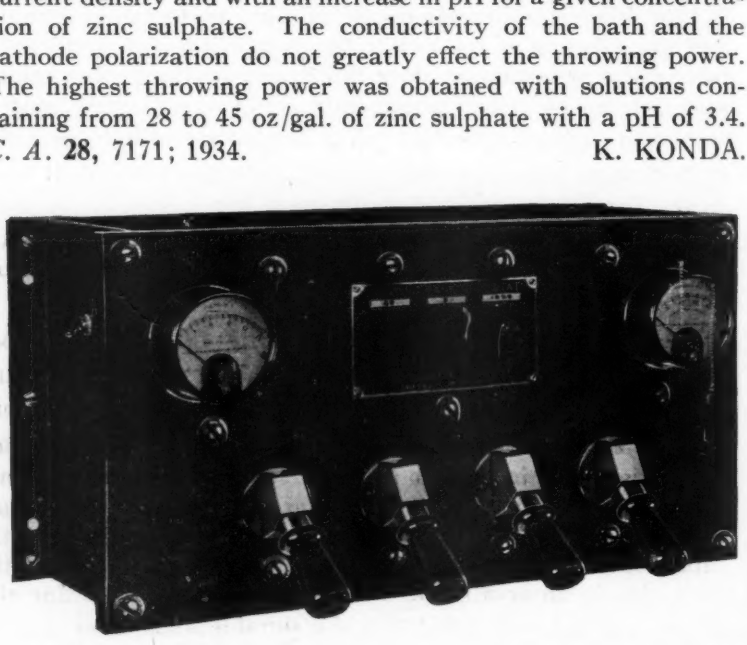
Economical Viewpoint in the Electrolytic Galvanizing of Iron and Steel Strips. H. MEYER auf der Heide. *Oberflächentechnik*, Vol. 21, Sept. 25, 1934, pages 202-204.—An advantage claimed for electrogalvanizing over hot galvanizing is that the electrodeposited zinc is more uniformly distributed and the adhesion of the zinc to the base metal is so perfect that mechanical deformation does not cause peeling. Zinc plated material can be rolled, drawn, and stamped. Electroplating is employed especially for cold rolled iron strip and hardened steel strip in order to avoid changes in the properties that might occur during hot galvanizing. High purity of the materials is necessary for successful zinc plating. A modern zinc plating plant is described and the method of calculating the cost of the various items is explained. *M. A.* **5,** 572; 1934. H. A.

Electroplating of Alloys Containing Chromium. *Oberflächentechnik*, Vol. 11, July 3, 1934, pages 144-145.—Electrodeposits often adhere very poorly on alloys containing chromium. It is recommended to dissolve the chromium from the surface before plating by immersion in warm 30% hydrochloric acid until gas is evolved. After rinsing in water the objects can be plated in acid baths; alkaline or cyanide baths are not suitable for the initial coating but can be used for further deposition after an initial deposition in an acid bath. Another method for obviating this difficulty is to brush a thin film of a suitable solder over the surface to serve as an intermediate layer on which the plated metal can be deposited; this solder may consist of zinc, tin, cadmium and lead. The process of Koepf does not necessitate a pre-treatment, but the surface of chromium or chromium alloy is plated in a strongly acid solution, with a pH of 2.5 or less. The explanation is that strongly acid baths overcome the passivity of chromium and activate it so that a deposit adheres firmly; however thick deposits should not be made from the acid bath. Instead only a thin initial layer is plated from the strongly acid bath, followed by further plating in a usual nickel bath such as the following formula, in oz/gal. Nickel sulphate 27, sodium sulphate 4, boric acid 3, ammonium chloride 1.5, sulphuric acid to the desired acidity. *M. A.* **5,** 573; 1934. H. A.

The Throwing Power of Zinc Sulfate Solutions. MASAMI NAKAJIMA, *J. Electrochem. Assoc.* (Japan) **2,** 176-

81; of *C. A.* **28,** 3307 (8). — The relation between the current density and the throwing power of zinc sulphate solutions was determined both by gravimetric and potentiometric methods.

In all cases the throwing power increases with an increase in current density and with an increase in pH for a given concentration of zinc sulphate. The conductivity of the bath and the cathode polarization do not greatly effect the throwing power. The highest throwing power was obtained with solutions containing from 28 to 45 oz/gal. of zinc sulphate with a pH of 3.4. *C. A.* **28,** 7171; 1934. K. KONDA.



Front view of the Udylite rheostat showing mounted instruments and switches.

THE UDYLITE RHEOSTAT

For all electroplating processes, The Udylite Company, Detroit, Michigan, has designed and built a rheostat into which are incorporated the features of close current regulation, ruggedness, compact construction and simplicity of operation. No effort has been spared to produce a quality instrument which will continue to function accurately under severe conditions.

Switch

The efficiency of any rheostat depends largely on the performance of its switches. For this reason, Udylite engineers have chosen self cleaning, constant pressure, cam type switches of their own improved and refined design. These refinements, together with improved methods of manufacturing result in a rheostat switch which is definitely superior to any on the market.

The Udylite cam switch is designed to provide perfect contact at the low plating voltages. This perfect contact is ensured by grinding the switch leaves when the switch is in a closed position. Ample contact surface and current carrying capacity have been provided.

The contact pressure firmly holds

each leaf perfectly flush against the bus bar without distortion. Pressure is always perpendicular to the contact surface. It is equalized on all leaves and is equally divided between the two contact surfaces. Inner and outer leaves are made of heavy spring bronze while the current carrying center leaves are of spring brush copper. These materials maintain their shape indefinitely.

The leaves of the Udylite cam switch are actually multiple cleaning units. They provide a wiping action on the surface of the bus which keeps the contact surface clean and ensures positive contact at all times and at all points.

The switch, when open, cannot make an accidental sparking contact because of the sturdy steel spring which holds it away from the bus bar.

Resistors

Long life and ruggedness are characteristic of the Udylite resistors which are of helical coiled, michrome wire.

The low amperage coils, which generally receive hardest service, are overdimensioned for higher voltage drops. Coil brackets have unusually large radiating surface resulting in cooler contacts of the resistor coils.

Cooling of the resistors is accomplished by a chimney draft action. Cool air is drawn upward through the resistors enclosed on four sides by the rheostat casing.

These improvements in rheostat construction eliminate overheating.

Corrosion Prevention

Udylite-Cadmium coatings are used on contact surfaces by the leading manufacturers of electrical products because of their ability to cut down contact resistances. For this reason, all contact surfaces of the Udylite rheostat are Udylited to permit positive transmission of electrical current.

All metal parts, with the exception of switch leaves and resistance coils, are Udylite to prevent the possibility of electrolytic corrosion as the result of contact between dissimilar metals.

Instruments

Ammeter and voltmeter are of the highest quality obtainable and were carefully selected as being most accurate and serviceable. They are securely fastened on the front of the board where they are in full view of the operator. The ammeter shunt is located below the resistors, away from heat, ensuring reliability of instrument readings. A double throw, single pole, voltmeter switch is mounted on the rheostat to permit reading of the voltage drop across the tank and across the line.

Help ! !

A Plater With Many Years of Experience

in all kinds of metal work, development, production and especially finishing, polishing, plating, lacquering, and enameling

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This man's experience covers children's vehicles, the manufacture and finishing of all kinds of electrical appliances, as well as complete hardware and specialty lines.

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"HOW IT IS DONE"

23rd ANNUAL CONVENTION AND EXPOSITION

American Electro-Platers' Society

BRIDGEPORT, CONN.

JUNE 10-11-12-13-14, 1935

Among Those Present

You will find over seventy-five leading manufacturers and jobbers displaying their merchandise for the inspection of thousands of users as well as consumers who will be in attendance afternoon and evening.

To Manufacturers of Metal Finished Appliances

The Society extends an invitation to you to Exhibit your Metal Finished Products such as household appliances and other devices to thousands of consumers, with the additional assurance for you to lay up a reserve of new ideas and practical methods of improving your product resulting from the intensive metal finishing research of the past few years.

Your Great Opportunity

The 1935 combined convention and exhibition offers a rare opportunity for you to lay up a reserve of new ideas and practical methods. Discussions of society members and exhibitors will enable you to check your methods against those of experts. Determine now that you will be among those present and mail your contract carly for choice location.

Local and State Co-Operation

You are assured the contributing interest of the Bridgeport Chamber of Commerce, the Manufacturers Association of Bridgeport, and the State association of Hartford. The Manufacturers Association will make a personal appeal by letter to the management of various New England concerns to have their key men interested in your products visit this exposition.

The management of this show has on two different occasions sponsored two mechanical exhibitions in this particular building and based on experience gained there should be very little, if any, additional expense other than space contracted for.

New England Market

The New England market, original field of metal finishing, affords an expansive and almost unlimited field for sales opportunities. This exhibition offers you the opportunity to contact the personnel and buying powers of many nationally known concerns. Today plant executives are more keenly alert than ever to the necessity of modern equipment, materials and methods and are awaiting the opportunity to attend this exhibition to learn more about developments during the past few years in the plating and metal finishing fields.

Get Full Benefit of Our Advertising

Monthly from now until the Exposition opens your name as an Exhibitor will be brought forcibly to the attention of thousands of users and consumers of your Metal Finished Products, Metal

This year's exposition will be the most important in the Society's entire history, due

Finishing Equipment and Supplies, through the medium of the leading trade journals, the Society's national publication, and by direct mail advertising.

Booths and Equipment

The space available consists of:

17 booths, size 10 ft. x 10 ft., wall.

50 booths, size 7 ft. x 10 ft., center. See floor plan.

For the period of the exhibition a charge of $100 per booth is asked. The management, however, prefers assigning the larger booths to exhibitors with bulky displays. Booths of standard construction will be erected, decorated and standard name signs will be furnished, also two chairs.

Select Your Space Now

Allotment of space will be made in the order received. It is advisable in sending your reservation to give first, second and third choice. Contracts for space will be forwarded about January 15, 1935.

Installing and Removing Exhibits

The space will be available for installing exhibits Saturday morning, June 8 and Sunday, June 9, 1935. Exhibits are to be completely removed from the building by Saturday, June 16. A limited amount of space is available for holdover shipments.

Insurance

Exhibitors wishing to insure their goods may do so at their own expense. The management will provide day and night watchmen and will use all reasonable care to protect exhibitors against loss.

Exhibition Hours

The exhibition will open Monday, June 10 at 1 p.m., and close at 10 p.m. Each day thereafter, including Friday, June 14, the hours will be from 1 p.m. to 10 p.m.

Power

The power available is single phase, 110 volts, A.C., and 220 volts, 3 phase, A.C., and precludes the possibility of heavy operating machinery. Extra wiring, however, for additional power can be arranged at the exhibitor's expense.

Method of Shipping Exhibition Materials

Consign all freight to YOURSELF prepaid, care of C. Rickard & Son (trucking company).

The management will see that your materials are delivered direct to your booth.

Consign express or parcel post shipments to YOURSELF at the Pyramid Temple Mosque, 1035 State Street, Bridgeport, Connecticut.

All return freight shipments properly crated or boxed will be delivered to local freight house and proper receipts mailed.

The above arrangements will work to the mutual advantage of all concerned and the transportation of your materials both from and back to the local freight station will be taken care of at no cost to the exhibitors.

Parking

Ample free parking space for 500 cars is available directly adjacent to the exhibition hall.

Address All Correspondence Relative to Exposition to

R. T. PHIPPS, *Manager of Exposition*
271 Grovers Ave., Bridgeport, Conn.
Home Phone: 3-5207 Business: 5-4151

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Convention Briefs

Mr. Joseph Phipps has been engaged as business manager of the exhibition. Already about twenty-four concerns have indicated their desire to exhibit. The public can visit the display, which will be by paid admission, and will be held in the Shrine Mosque.

- - -

There will be a New England Day at the Convention, in which all papers read will be by practical foremen platers in New England. Inasmuch as the Founder's Gold Medal has not been bestowed for several years, there should be an award made this year.

- - -

The Educational Sessions will last four days. The exhibition five days. The International Fellowship Club as usual, will hold their Good Will "party" the first night of the Convention. This is becoming one of the leading social events and is becoming more and more popular each year.

- - -

The ladies' program is to be better than ever this year. The State of Connecticut is having a Tercentenary celebration and many places of historic interest may be visited. New England's scenic beauty will be at its best about this time; there are many charming places that can be reached in other States outside of Connecticut, within a short time from Hotel headquarters.

- - -

The educational program will be of particular interest. There will be papers on—

X Ray of deposits and base Metals.

Spectograph analysis of solutions, chemicals and deposits.

Maximum Metal Concentration of Nickel Solutions.

Air conditioning plating, buffing and lacquer rooms.

Moving pictures of the working of a plating solution.

Value of Synthetic resins on Metals.

Why Metals corrode.

Metallizing by the Spraying of Molten Metal.

Metallizing by the Sputtering process.

Specifications for electro-deposited coatings.

Book Review—Modern Polishing on a Production Basis—Fred B. Jacobs Iron Age, 134, 23 P 16 - 19 Dec. 6, 1934. — A description is given of the methods of making up wheels, handling of work and polishing of work at the White Sewing Machine Co. 12 Photographs.

E. T. CANDEE

CHICAGO BRANCH

The regular monthly meeting of the Chicago Branch was held December 8th at the Atlantic Hotel. President E. G. Stenberg presiding and all other officers present. A new application was received from J. Schulein and committee appointed on same.

Mr. F. J. Hanlon, Chairman of the Banquet Committee reported that all plans were completed for our 23rd Annual Banquet to be held at the LaSalle Hotel on January 19, 1935.

Mr. D. Greenblatt showed some samples of oblong German silver frames, chrome plated, and described the methods used for plating into the corners of same.

The meeting was very well attended which put plenty of pep into the discussion of many questions found in the Question Box by our Librarian and all members that do not attend our meetings regularly are sure losing a very interesting evening as well as a lot of knowledge.

Mr.O.E.Servis, our Librarian, found the following questions in the Question Box:

1. *What is correct, Metallic Content, Chloride Content - P. H. and Voltage for barrel plating nickel solution?*

Ans. Metallic content sufficient for type of work being done anywhere from 2 to 6 oz. per gallon. Chloride content sufficient to dissolve anodes. It somewhat depends on what Chloride is used. It was suggested that ammonium chloride was best for barrel plating.

P. H. can be anywhere from 5.4 to 6.2 depending on type of work.

Voltage anywhere from 6 to 12 volts depending on type of work, amount, etc. Speed of barrel is also a matter of importance.

2. *How can you change a double nickel salt solution to a single salt solution?*

Ans. Just continuing adding single salts will gradually turn this solution over to a single salt solution for all practical purposes.

3. *What causes an Aluminum Oxide on a cleaning tank where no Aluminum comes in contact with said work?*

Ans. It may be caused by various means: namely, from some forms of Buffing compound or some forms of cleaners.

4. *What will happen if iron is introduced into sulphuric anodic aluminum treating solution.*

Ans. No harm will result unless iron content is very high.

5. *What pickle formula is recommended for removal of scale and oxide from vanadium - chrome forged steel?*

Ans. 30% sulphuric acid pickle with about 1 oz. of an inhibitor to a gallon. Afterwards run in an alkaline cleaning solution with reverse current.

6. *Is it practical to lacquer or enamel sheet zinc, or terneplate metal or cadmium plated steel? If so, how should it be prepared before application?*

Ans. It is practical to lacquer either of above metals. Depends on whether you want a bright clear lacquer or an enamel surface. Many of the lacquer firms can furnish you with the proper material.

7. *How can nickel anodes that have been used in a black nickel solution be cleaned so that they may be safely used in a regular solution?*

Ans. Clean in a strong Mur. Acid for a few minutes or back off in a regular sulphuric strip for a few minutes.

8. *Are 99 plus nickel anodes superior 95-97 except for dirt. If not, does bagging of 95-97 nickel anodes give equal results to 99 plus.*

Ans. Many suggestions offered. If used in a cold solution it was thought 95-97 would give good results without bagging.

9. *What can be used for holding warm oxidizing sulphurette of Pot. when a crook is too small? Iron tanks eat out quite rapidly and ceramic tank is too expensive.*

Ans. Use heavy wood tank.

10. *Want cleaner formula (Home-made) for cleaning die castings.*

Ans. 2 Oz. Soda Ash, 4 Oz. Tri-sodium to a gallon of water with direct current.

11. *What effect has warming a nickel solution on the p H.?*

Ans. Warming the solution causes the pH. to decrease. J. W. HANLON

HARTFORD BRANCH

The Hartford Branch held a joint meeting with the American Society for Metals, on Monday evening, November 26, 1934, at the Hartford Electric Light Co., of Hartford, Conn.

The meeting was opened at 8.30 P. M. with Pres. St. Pierre in the Chair. After a few brief remarks, Mr. Henry Fischbeck, Chief Chemist of the Pratt & Whitney Co., conducted the meeting, introducing Mr. Geo. B. Hogaboom, as the speaker of the evening.

Mr. Hogaboom gave a very fine talk, accompanied by many interesting slides on "What Is Under the Plate?" His talk was one of the finest we have heard for many months. After conducting the discussion which followed the talk, Mr. Fischbeck turned the meeting over to Pres. St. Pierre. In conclusion, Mr. Hogaboom was given a rising vote of thanks for his fine talk.

At this meeting Mr. J. W. Backus was elected as an Active Member, also Mr. Norman Mosesian of 77 Hamilton Ave., Norwich, Conn., was reinstated as an Active Member.

The meeting was attended by nearly one hundred members and visitors and was adjourned at 10.30 P. M.

V. E. GRANT

DETROIT BRANCH

A regular meeting of the Detroit Branch was held on Friday evening at 8:00 P.M., December 7th, 1934, in the Ballroom of Hotel Statler, Detroit, Michigan. Col. Hansjosten presided. Over 100 people attended. Minutes of previous meeting were read and approved.

A letter received from the widow of J. H. Jenkinson, and Secretary instructed to write a letter of condolence. A letter read from Elmer Woodmansee, an active member, asking for transfer to Chicago Branch; transfer granted and Secretary instructed to do the necessary.

Applications received: Howard Knight, 12742 Longview Ave., Detroit (Active), and R. W. Jewel, 244 S. Marshall St., Pontiac (Active). These applications were referred to the Board of Managers for investigation and report.

The application of Mr. F. J. Waugh was reported on by the Board of Managers and he was unanimously elected to Active Membership.

It was reported that Mr. and Mrs. L. P. Brockway had had a very serious automobile accident, and that they were both in the Henry Ford Hospital. While Mrs. Brockway had been removed to her home, Mr. Brockway was still in the Oxygen Ward of the hospital. The members expressed

deep regret at this and a sincere hope that Mr. Brockway will pull through.

The paper of the evening—"Electric Deposition of Metals Magnified" was then presented by Mr. Wm. Phillips, ably assisted by Messrs, Clift and Worshing of the General Motors Laboratories. The illustrations were presented on the screen in the form of moving pictures showing the action of the current and solution on both cathode and anode. This paper was very interesting as well as instructive and entertaining, although the slides showed all the action upside down, which was very confusing for a while until one got used to standing on his head to look at it, especially so when in one of the slides the plater was shown going down in the bottom of the tank to see what was the matter with it. There were quite a lot of questions asked and answered, which of course I have not been able to make a record of. Mr. Phillips was given a rising vote of thanks, also great applause.

(NOTE: Any Society wishing to put on a special program at any time might induce Mr. Phillips to show these slides at their meeting. Mr. Phillips can be reached at the General Motors Building, Research Laboratories, Detroit, Mich.)

There being no further business, the meeting adjourned and was immediately followed by the serving of sandwiches, crackers, cheese, beer, etc.

T. C. EICHSTAEDT

MILWAUKEE BRANCH

The regular meeting of Milwaukee Branch was held at Lipp's Hall, Thursday evening, Dec. 13, 1934. The meeting was called to order by President Pat Sheehan. A good attendance was present. Several new and old faces were present, which is indicative that our Branch is again doing something worth while. Robt. Steuernagel suggested we have a smoker some time this Spring and President Pat Sheehan appointed a committee of three to begin work: Dan Wittig, Robt. Steuernagel and Vice-President Dexter Rhodes. We would like to have some of the excellent papers submitted in the past from among our local members. We are aiming for an even better and more entertaining meeting than last Spring. So let us get behind our committee 100 per cent.

A quite badly blistered red brass chromium finished faucet was shown, and discussion was invited as to what caused the poor condition. It was decided that a combination of poor cleaning and internal stress was to blame.

Mr. Jac Hay delivered a talk on his paper "What Effect has the Shape of an Article on Throwing Power?" Slides were also shown. Mr. Hay was given a rising vote of thanks by the boys, and then the discussion started as to which is the better nickel solution for throwing into deep recesses, a low nickel content, or a high nickel content. From the discussion involved it was apparent that a low nickel high pH. cold solution should throw the best. Due chiefly to the fact that depletion of Nickel ions at near points on cathodes would be replenished as quickly as in a high metal content bath.

No offense, Chicago Branch! but in the December issue of the REVIEW, you answer question No. 1 in a manner which is rather dubious to us.

FRANK J. MARX

ST. LOUIS BRANCH

The regular meeting of St. Louis Branch was held on Friday, December

7, 1934, at which time a dinner was served and we had a large crowd. After dinner the meeting was held and was called to order by our President J. Vogt. Roll call of officers showed one absent. The minutes of previous meeting were read and approved. One application was read and accepted to membership. Meeting was turned over to Librarian and many questions were asked. After all were answered, they called on Dr. Stout, of Washington University, who gave us a very interesting talk on some of his experiences in plating with the different metals and alloys and the results obtained.

Our next meeting will be held at 2822 La Salle St., and we will have moving pictures. We expect to have another large crowd.

CHAS. T. MCGINLEY

CLEVELAND BRANCH

The regular monthly meeting of the Cleveland Branch was held at Hotel Carter, Saturday, December 1st, 1934. The meeting was called to order by our president, W. D. Scott. The minutes of the previous meeting were approved.

A letter from the Department of Commerce on Specifications for Plating on Steel, and one from the Bureau of Standards on Exposure of Non-Ferrous Metals, an invitation to join the Electro Chemical Society Inc.; these letters were all read and ordered filed. The meeting was then turned over to our Librarian Mr. Thompson, who introduced Mr. Tuttle, president of The Zialite Corporation, who gave us a very splendid talk on Nickel Plating Die Castings, he had a small but very efficient set up with which he proceeded to plate various parts of Zinc base Die Castings, sheet Zinc, showing that it had a very good throwing power.

Mr. Tuttle then agreed to answer questions asked of him which were:

Question: *What advantage if any has it over a regular solution*?

Answer: It has a much better deposit and color.

Question: *How does solution plate in barrels on other metals for instance steel or brass*?

Answer: There is no difference if any favors of Zialite because of the better throwing power.

Question: *Is there any pitting in Zialite*?

Answer: Yes, sometimes due to an excess of Ammonium.

Question: *Would it be necessary to use Hydrogen Peroxide in solution to prevent pitting*?

Answer No.

Question: *Will work have to be buffed*?

Answer: Yes, as this is not a bright solution.

Question: *In a large installation would the gas given off be injurious*?

Answer: No.

After some discussion in groups the meeting was adjourned.

WM. E. O'BERG.

BRIDGEPORT BRANCH

The regular meeting of the Bridgeport Branch was held on December 7 in the Chamber of Commerce Rooms of the Stratfield Hotel. Al. Rosenthal, president, presided over the meeting, at which there were twenty-six members present. The chair was immediately turned over to Ray O'Connor, chairman of the Convention Committee who introduced Mr. R. T. Phipps, who will have full charge of the exhibits at the coming Convention, in June. Mr. Phipps gave the details as to how the exhibits will be handled and with the assistance of the Chamber of Commerce and the Manufacturers' Association the Convention should prove to

be as successful an affair as has ever been held in the city.

Unforeseen circumstances prevented Mr. George Hogaboom from speaking to us at this meeting, as had been planned, but arrangements have been made to have Mr. Hogaboom speak at an Open Meeting on February 1. This meeting will be open to all. We cordially invite and urge members of other branches to be present. Members of the Program Committee, George Knecht, George Wagstaff, and John English have completed plans to have Mr. Floyd Taylor of the Bullard Machine Co. of Bridgeport address the members at the January meeting, his subject will be "Electrical Appliances in Connection with the Plating Industry."

George Wagstaff donated the prize for the evening, a pen and pencil set. It was won by Mr. Jon Barry who will donate the prize for the meeting on January 4. Why not come around, you may be the lucky winner!

WILLIAM FLAHERTY.

BALTIMORE-WASHINGTON BRANCH

At our last meeting on December 8, we took in another member, Mr. Talmade R. Boggess. This makes seven (7) new members this fall.

We had a wonderful meeting, the largest attendance for over two years, more enthusiasm and fellowship displayed. After the short business session, we had a question box and it was late in the evening when we closed, carrying over nearly one half of the questions, which we will discuss at our meeting on January 5.

The Baltimore-Washington Branch will hold its annual dinner and educational session at the new Howard Hotel, Howard St., Baltimore, on Saturday, February 2, 1935.

Dinner at 6:30 P.M. Tickets, $1.25 each. Dr. Blum and Mr. Wendall P. Barrow have prepared the following program for the educational meeting which will be held following the dinner:

1. W. M. Phillips, General Motors Corporation. *"The Process of Electrodeposition."*

This will be illustrated by reproducing on the screen the actual processes occurring in copper, nickel, and chromium deposition.

2. P. W. C. Strausser, Research Associate. *"The Use of Dropping Tests for Determining the Thickness and Distribution of Electrodeposits."* (With demonstration).

3. Discussion of Proposed Specifications for Plating on Steel.

IRVIN H. HAHN.

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Associate, Dayton Branch

Peter Borghetti, 2552 N. Parkside Ave., Chicago, Ill.
Active, Chicago Branch

James Barnes, 517 Westmont Ave., Toronto, Canada
Active, Toronto Branch

Wm. J. Allcock, 130 Langley Ave., Toronto, Canada
Active, Toronto Branch

Alfred J. Reilly, 195 South Washington St., N. Attleboro, Mass.
Associate, Providence Branch

Joel W. Backus, c/o Silex Co., Pliny St., Hartford, Conn.
Active, Hartford Branch

K. Ralph Atkins, 6139 Marshall St., Philadelphia, Penna.
Active, Philadelphia Branch

Arnold H. Anderson, c/o Individual Drinking Cup Co., Easton, Pa.
Associate, Philadelphia Branch

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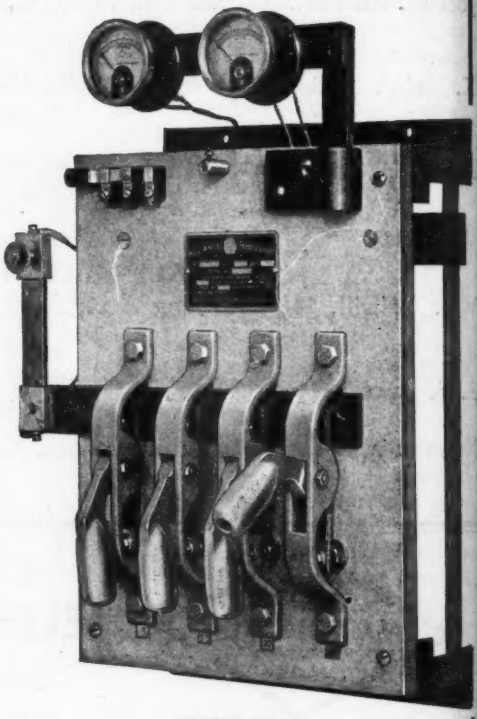

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